DR. EDOARDO MILANA

Born in Rome, Italy 22/10/1990
Nationality: Italian
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milana.edoardo@gmail.com
Google Scholar

LANGUAGES

Italian: Native
English: Advanced
German: Intermediate
French: Intermediate

EDUCATION

Ph.D., Mechanical Engineering, KU Leuven
Leuven, Belgium, 11.2016-10.2020
Concentrations: Soft Robotics, Biomimicry, Microengineering
Dissertation: *Biomimetic ciliary propulsion. Soft robotic actuation and morphological control* Dissertation Advisors: Prof. Dominiek Reynaerts, Prof. Michael De Volder, Prof. Benjamin Gorissen

M.Sc., Nanotechnology Engineering, Sapienza University of Rome
Rome, Italy, 1.2013-4.2015
Concentrations: Nanotechnology, Microengineering, Materials Science
Thesis: *Conducting PDMS nanocomposite sensing pneumatic microactuators*
Thesis Advisor: Prof. Antonio Carcaterra

B.Sc., Mechanical Engineering, Sapienza University of Rome
Rome, Italy, 9.2009-11.2012

RESEARCH EXPERIENCE

Postdoctoral Research Associate, German Aerospace Centre (DLR)
Sankt Augustin, Germany, 11.2020-Present
Institute for the Protection of Terrestrial Infrastructures.
Autonomous robotic systems for civil security and infrastructures safety.
Ultra-fast soft robotic gripper.
Computer vision for semantic navigation.
System integration on Boston Dynamics Spot.

Research Assistant, KU Leuven
Leuven, Belgium, 11.2016-Present
Design, simulation and manufacturing of soft actuators and bioinspired robots.

Simplified control and Embodied Intelligence in Soft Robots.

Visiting Researcher, University of Milan
Milan, Italy, 9-12.2019
Ionogels electroactive soft actuators.
Supervisor: Prof. Paolo Milani

Research engineer, Ecole Polytechnique
Paris, France, 6.2015-10.2016
Development of a soft Weigh-In-Motion system based on nano-enabled strain sensors.

TEACHING EXPERIENCE

Teaching assistant:

2016/2017:
Problem Solving and Design: Industrial project (3nd year Bachelor Engineering Science)
2017/2018:
Problem Solving and Design: Industrial project (3nd year Bachelor Engineering Science)
Problem Solving and Design: Soft Robotics (2nd year Bachelor Engineering Science)
2018/2019:
Problem Solving and Design: Industrial project (3nd year Bachelor Engineering Science)
Problem Solving and Design: Soft Robotics (2nd year Bachelor Engineering Science)
2019/2020:
Problem Solving and Design: Industrial project (3nd year Bachelor Engineering Science)
Problem Solving and Design: Soft Robotics (2nd year Bachelor Engineering Science)

Master thesis mentor:

2017/2018:
Bert Van Raemdonck. *Design and tuning of an elastic inflatable actuator with a non-linear response.* (Mechanical Engineering - KU Leuven)
Andrea Serrano. *Tuning the non-linear response of soft inflatable micro-actuators.* (Mechanical Engineering - KU Leuven)
2018/2019:
Eline De Borre. *Microfabrication of a biomimetic ciliary propulsion system via soft lithography.* (Nanotechnology Engineering - KU Leuven)
2019/2020:
Paolo Azzini. *Fabrication and characterization of soft microactuators based on ionogels/gold nanocomposite.* (Physics - University of Milan)
Jennen Joost. *Actuation sequencing of multi-segmented soft robots.* (Mechanical Engineering - KU Leuven)
Sean Flaherty. *Structural design and hydrodynamic characterization of halfmoon artificial cilia* (Mechanical Engineering - KU Leuven)

Nithin Johnson. *Modelling and control of a soft robot: artificial cilium.* (Artificial Intelligence and Robotics – Sapienza University of Rome)
2021/2022:
Akan Umutcan. *Model-based control of artificial cilia*. (Mechanical Engineering – KU Leuven)

RELEVANT SKILLS

Programming ability in Python, Matlab, Bash, LabView
Robotics: ROS
CAD: Siemens NX, Solid Edge
FEM analysis: Ansys, Abaqus, Comsol
Graphics: Inkscape

AWARDS AND GRANTS

University of Freiburg - Freiburg Rising Stars Academy Class 2021/2022

The Research Foundation – Flanders (FWO) Grant for participation in a conference abroad Travel costs for the 2022 IEEE International Conference in Soft Robotics at University of Edinburgh

Best Communication Paper Award at 2021 IEEE International Conference in Soft Robotics For the paper "Model-Based Control Can Improve the Performance of Artificial Cilia", Virtually hosted by Yale University, USA

The Research Foundation – Flanders (FWO) Senior Research Project
I co-wrote the project proposal "Enhancing morphological computation in soft robots through elastic structural instabilities". Recipient of the grant is prof Reynaerts, my PhD promoter. Funds: 239.000€ for 2020-2023

The Research Foundation – Flanders (FWO) Grant for a long stay abroad
Two months at University of Milan, the grant covered travel costs + allowance of 1650€ per month

INTERNATIONAL CONFERENCES ORAL PRESENTATIONS

"Network theory for morphological control of soft robots", at 25th International Congress of Theoretical and Applied Mechanics (ICTAM 2020+1), Virtual, July 2021

"EELWORM: a bioinspired multimodal amphibious soft robot" at 3nd IEEE International Conference on Soft Robotics (RoboSoft), Virtual, May 2020

"Exploiting mechanical nonlinearities to sequentially inflate multiple soft actuators" at XXIV Congress of the Italian Association of Theoretical and Applied Mechanics, AIMETA 2019, Rome, Italy, September 2019

“Precise bonding-free micromoulding of miniaturized elastic inflatable actuators” at 2nd IEEE International Conference on Soft Robotics (RoboSoft), Seoul, Korea, April 2019

“Microfabrication of a biomimetic ciliary propulsion system via soft lithography” at SIG Meeting: Micro/Nano Manufacturing, University of Strathclyde, Glasgow, November 2017

INTERNATIONAL CONFERENCES POSTER PRESENTATIONS

“Towards half-moon-shaped soft pneumatic cilia”, at 5th IEEE International Conference on Soft Robotics (RoboSoft), Edinburgh, UK, April 2022

“Model-Based Control Can Improve the Performance of Artificial Cilia”, at 4th IEEE International Conference on Soft Robotics (RoboSoft), Virtual, April 2021

“Hardware encoded inflation sequence with nonlinear soft actuators” at Solvay Workshop on "Mechanics of slender structures in physics, biology and engineering: from failure to functionality" Brussels, Belgium, August 2018

“Design and characterization of soft microactuators based on interconnected pneumatic networks” at euspen’s 18th International Conference & Exhibition, Venice, Italy, 2018

“Design of a bi-segmented soft actuator with hardware encoded quasi-static inflation sequence” at 1st IEEE International Conference on Soft Robotics (RoboSoft), Livorno, Italy, April 2018

SEMINARS AND TALKS

“When soft robots meet metamaterials”, at Freiburg Rising Stars Conference, University of Freiburg, Freiburg, Germany, March 2022

“Biomimetic ciliary propulsion. Soft robotic actuation and morphological control”, public PhD defense at Department of Mechanical Engineering, KU Leuven, Leuven, Belgium, October 2020

“Biomimetic ciliary propulsion with soft robotic microactuation” at Insitute for Advanced Simulation, FZ Juelich, Germany, July 2020

“Soft robotic cilia for biomimetic fluid propulsion” at the Department of Physics of University of Milan, Milan, Italy, August 2019

“Micro and Precision Engineering research at KU Leuven” at AMOLF, Amsterdam, The Netherlands, November 2017

PUBLICATIONS

Journal Articles

Milana, E., Gorissen, B., De Borre, E., Ceyssens, F., Reynaerts, D., De Volder, M. Out-of-Plane Soft Lithography for Soft Pneumatic Microactuators Arrays. *Soft Robotics* (accepted for publication)

Aubin, C. A., Gorissen, B., **Milana, E.**, Buskohl, P. R., Lazarus, N., Slipher, G. A., Keplinger, C., Bongard, J., Iida, F., Lewis, J. A., Shepherd, R. F. (2022) Towards enduring autonomous robots via embodied energy. *Nature*, 602

Milana, E., Van Raemdonck, B., Bayens, A., De Volder, M., Reynaerts, D, Gorissen, B. (2022) Morphological control of cilia-inspired asymmetric movements using nonlinear soft inflatable actuators. *Frontiers in Robotics and AI,* 8

Piazzoni, M., Piccoli, E., Migliorini, L., **Milana, E.**, Iberite, F., Vannozzi, L., Ricotti, L., Gerges, I., Milani, P., Marano, C., Lenardi, C., Santaniello, T. (2021). Monolithic Three-Dimensional Functionally Graded Hydrogels for Bioinspired Soft Robots Fabrication. *Soft Robotics*.

Milana, E., Zhang, R. Vetrano, M. R., Peerlinck, S., De Volder, M., Onck, P. R., Reynaerts, D., Gorissen, B. (2020) Metachronal patterns in artificial cilia for low Reynolds fluid propulsion. *Science Advances*, 6 (49)

Milana, E, Santaniello, T, Azzini, P, Migliorini, L, Milani, P. (2020) Fabrication of High-Aspect-Ratio Cylindrical Micro-Structures Based on Electroactive Ionogel/Gold Nanocomposite. *Applied Nano,* 1 (1)

Milana, E., Bellotti, M., Gorissen, B., Qian, J., De Volder, M., Reynaerts, D. (2020). Shaping Soft Robotic Microactuators by Wire Electrical Discharge Grinding. *Micromachines*, 11 (7)

Milana, E., Gorissen, B., Peerlinck, S., De Volder, M., Reynaerts, D. (2019). Artificial Soft Cilia with Asymmetric Beating Patterns for Biomimetic Low-Reynolds-Number Fluid Propulsion. *Advanced Functional Materials*, 29 (22)

Gorissen, B., **Milana, E.**, Baeyens, A., Broeders, E., Christiaens, J., Collin, K., Reynaerts, D., De Volder, M. (2019). Hardware Sequencing of Inflatable Nonlinear Actuators for Autonomous Soft Robots. *Advanced Materials*, 31 (3)

Proceedings of international conferences (peer-reviewed)

Milana E., Peerlinck S., Flaherty S., Reynaerts D., Gorissen B. (2022) Towards half-moon-shaped soft pneumatic cilia. In: Proceedings of the 2021 5th IEEE International Conference on Soft Robotics (RoboSoft).

Milana E., Stella F., Gorissen B., Reynaerts D., Della Santina C. (2021) Model-Based Control Can Improve the Performance of Artificial Cilia. In: Proceedings of the 2021 4th IEEE International Conference on Soft Robotics (RoboSoft).

Milana, E., Van Raemdonck, B., Cornelis, K., Dehaerne, E., De Clerck, J., De Groof, Y., De Vil, T., Gorissen, B., Reynaerts, D. (2020). EELWORM: a bioinspired multimodal amphibious soft robot. In: 2020 3rd IEEE International Conference on Soft Robotics (RoboSoft)

Milana, E., Bellotti, M., Gorissen, B., De Volder, M., Reynaerts, D. (2019). Precise bonding free micromoulding of miniaturized elastic inflatable actuators. In: Proceedings of the 2019 2nd IEEE International Conference on Soft Robotics (RoboSoft).

Bellotti, M., **Milana, E**., Gorissen, B., Qian, J., Reynaerts, D. (2018). Wire electrical discharge grinding of micro rods for bonding-free fabrication of soft pneumatic micro actuators. In: European Society for Precision Engineering and Nanotechnology, Conference Proceedings - 18th International Conference and Exhibition, (413-414)

Milana, E., Bellotti, M., Gorissen, B., De Volder, M., Reynaerts, D. (2018). Design and characterization of soft microactuators based on interconnected pneumatic networks. In: European Society for Precision Engineering and Nanotechnology Conference Proceedings, (209-210).

Gorissen, B., **Milana, E**., Reynaerts, D., De Volder, M. (2018). Lithographic production of vertically aligned CNT strain sensors for integration in soft robotic microactuators. In: 2018 IEEE International Conference on Soft Robotics, RoboSoft 2018, (400-405).

Milana, E., Gorissen, B., De Volder, M., Reynaerts, D. (2018). Design of a bi-segmented soft actuator with hardware encoded quasi-static inflation sequence. In: 2018 IEEE International Conference on Soft Robotics, RoboSoft 2018, (108-113)

Book Chapters and Dissertations

Milana, E., Reynaerts, D. (sup.), Gorissen, B. (cosup.), De Volder, M. (cosup.) (2020). Biomimetic Ciliary Propulsion: Soft Robotic Actuation and Morphological Control. PhD Dissertation

B Gorissen, **E Milana**, M De Volder, D Reynaerts (2018) Artificial Pneumatic Cilia. Atlas of Cilia Bioengineering and Biocomputing, 61